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'Unequivocal Proof' of Yellow-Rain Weapons

The following are summaries of four studies on yellow rain that have been published in peer-reviewed scientific journals from 1982 to 1985. A related editorial appears today.

Journal of the Association of Official Analytical Chemists (Vol. 66, No. 6, 1983)

"Analysis for Fusarium Toxins in Various Samples Implicated in Biological Warfare in Southeast Asia"

Chester J. Mirocha, Robert A. Pawlosky, Kajal Chatterjee, Sharon Watson and Wallace Hayes

Abstract: "Samples of leaves, water, cereal grains, soil, and yellow powder as well as blood, urine, and body tissues from chemical warfare victims were analyzed for Fusarium toxins by using gas chromatography and mass spectrometry. The leaves, water, and yellow powder samples contained various combinations of T-2 toxin, diacetoxyscirpenol, deoxynivalenol, nivalenol, and zearalenone in concentrations ranging from trace (1.0 ppb [parts per billion]) amounts to 143 ppm [parts per million]. These trichothecenes do not occur naturally on the substrates described and were correlated with the so-called 'yellow rain' chemical attacks against Hmong people in Southeast Asia. Analysis of leaves, soil, water, and cereals collected in areas adjacent to but apart from the area where chemical attacks had been staged did not contain any Fusarium toxins. Moreover, T-2 and HT-2 toxins were

found in human blood, urine, and body tissues (heart, esophagus, kidney, lung, and large intestine) of alleged victims. In addition, diacetoxyscirpenol was found in the kidney of one person who had died."

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Biomedical Mass Spectrometry (Vol. 9, 1982)

"Presence of Four Fusarium Mycotoxins and Synthetic Material in 'Yellow Rain': Evidence for the Use of Chemical Weapons in Laos"

Robert T. Rosen and Joseph D. Rosen
Abstract: "Analysis of a 'yellow rain' sample [acquired by ABC News in March 1981] by selected ion monitoring revealed the presence of three trichothecenes: T-2 toxin, diacetoxyscirpenol and 4-deoxynivalenol in concentrations of at least 48, 42 and 58 ppm, respectively. The concentration of zearalenone, another Fusarium mycotoxin, was estimated to be at least 265 ppm. Evidence for a formulation which contained polyethylene glycol [a man-made compound] was also obtained."

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Fundamental and Applied Toxicology (Vol. 4, 1984)

"Analysis for Trichothecenes in Samples From Southeast Asia Associated With 'Yellow Rain' "

Sharon A. Watson, Chester J. Mirocha, and A.W. Hayes

Conclusion: "The finding of T-2 toxin, diacetoxyscirpenol, deoxynivalenol, zeara-

lenone, and fusarium pigments in leaves, water, yellow powder, and fragments originating at sites of Yellow Rain attacks in Southeast Asia and their absence in background samples (leaves, corn, rice, water, soil) from areas not exposed to Yellow Rain strongly implicate their use as warfare agents. Moreover, the finding of T-2 toxin and HT-2 toxin (a metabolite of T-2 toxin in animals) in the blood, urine, and tissue of alleged victims of these attacks provides unequivocal proof of their use as weapons."

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Journal of Forensic Science (April 1985)

"The Incident at Tuol Chrey: Pathologic and Toxicologic Examinations of a Casualty After Chemical Attack"

Charles J. Stahl, M.D.; Christopher C. Green, M.D., Ph.D.; and James B. Farum, M.D.

Abstract: "The results of the pathologic and toxicologic examinations of specimens from a casualty who died several weeks after a chemical attack in Kampuchea are discussed. While the effects of trichothecene mycotoxins have been described in domestic and experimental animals, there is a paucity of information about the pathologic effects of these toxins in humans. The possible effects of endemic diseases such as falciparum malaria, viral hepatitis, and nutritional deficiencies, as well as of the sudden, unexpected death syndrome among refugees from Southeast Asia, have been reviewed. If the results of the histologic examinations in this case are considered alone, it is not possible to establish a cause-effect relationship. However, the circumstances of injury, the relationship of pathologic findings to studies of experimental animals, and the results of the toxicologic examinations of environmental and biologic specimens indicate that the combinations of trichothecene mycotoxins detected are not consistent with natural occurrence and provide evidence that the pathologic effects are related to a toxic agent."